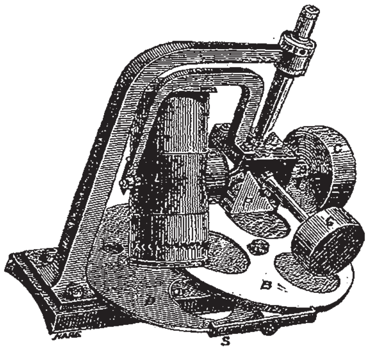
the speed may be altered from sidereal to lunar rate by merely raising the bob of the pendulum through a small space, so as to diminish the time of oscillation.

For special purposes, still greater accuracy might be obtained if the escapement were worked by the observatory clock by means of a small electro-magnet connected with the pendulum of the latter. Conversely, the escapement train might, with slight modifications and the addition of a dial, be made to serve as a journeyman-clock, and show sidereal time with sufficient accuracy to be very useful in finding stars during two or three hours' work.

There is, by the way, another important modification well worthy of notice. When astronomers wish to determine the position of a star, the diameter of a planet, &c., with rigorous accuracy, they employ a micrometer with spider webs, which in the daytime are visible in the field of view. At night, however, they, or the field itself, require to be lit up. This is managed by a lamp outside and a reflector inside the tube, and to make this lamp perform effectively in every position of the telescope is a difficult matter; so difficult, in fact, on the old arrangement, that Messrs. Cooke and Sons, with their wonderful ingenuity, have entirely superseded it in this their latest instrument. Their exquisite contrivance will be seen from the annexed woodcut.



THE COOKE ILLUMINATING APPARATUS.

L is the lamp. P, a prism to reflect the light on to the tube. D, a disc with diaphrams to regulate the quantity of light. B, a disc with glasses to regulate the colour of the light. S, spring catches to clamp these discs. C, counterpoise of lamp. G, Gravity poise.

The telescope is furnished with a sufficient battery of eye-pieces, of powers ranging from 30 to 400, and also with a bifilar micrometer. The position circle is permanently attached to the lower end of the main tube.

The observatory is erected on the roof of the western tower of the New Schools. It is square, and surmounted by a revolving dome. It is obvious that an instrument erected on a tower cannot be wholly free from vibration; but the latter is reduced to a minimum by supporting the telescope on two massive trussed iron girders stretching across the tower. The floor of the observatory is supported quite independently.

Owing to the unfavourable weather of late, the final adjustments of the telescope have not been completed; but it is hoped that before long it will be in a condition for good and accurate work, such as will justify the enlightened liberality which has placed it where it is.

H. G. MADAN

REMARKS ON TERRESTRIAL MAGNETISM

(*Being the substance of a paper read at the Royal Astronomical Society, on Friday, Dec.* 10)

SOME years since I was led to the belief that earth currents and auroræ are secondary currents produced by rapid, though small, changes in the earth's magnetism.

In this hypothesis the earth was viewed as similar to the soft iron core of a Ruhmkorff's machine, and the upper and rarer strata of the atmosphere and the moist upper surface of the earth as conductors in which secondary currents would be generated whenever any change took place in the magnetism of the core.

This hypothesis is, I think, confirmed by the very interesting and valuable photographic traces of earth currents obtained by Mr. Airy, at Greenwich, in which, during times of great magnetic disturbance, the earth currents are seen to be very strong, and to vary alternately from positive to negative, lying about equally on both sides of the zero.

It has occurred to me that this method of viewing things is capable of extension, and that it ought to be borne in mind that secondary currents are produced, not only in a *stationary conductor* such as that of the Ruhmkorff's machine, where the magnetic core is made to vary, but also in a conductor which moves in the presence of a magnetic core of constant strength.

Have we not in the earth such conductors in constant motion? We have the return trades constantly proceeding at a high elevation from the equator to the poles, the upper strata of which, from their tenuity, may no doubt be considered to be conductors; in their journey they cross the lines of the earth's magnetic force: ought they not, therefore, to be the vehicles of electrical currents? My friend Mr. Lockyer has lately impressed upon me that the zodiacal light may possibly be a terrestrial phenomenon, and, therefore, that it may be connected in some way with the phenomena of terrestrial magnetism. May it not be the return trades rendered luminous through electric currents in the higher regions of the atmosphere, and may there not also be two species of auroræ, the one occurring in stationary conductors, when the earth's magnetism changes, and the other, in moving conductors, when the earth's magnetism is constant?

But again, it must be allowed that these conductors conveying currents must react on the magnetism of the earth, and we might therefore expect that at those periods of the year at which the system of currents, viewed as meteorological phenomena, change most abruptly, the earth's magnetism would also be particularly liable to change. May not this be an explanation of the excess of magnetic storms about the times of the equinox?

But besides these great terrestrial currents, we have the daily convection currents caused by the sun, which, when they reach the upper regions of the earth's atmosphere, we may imagine to be conductors; and as they also pass across lines of magnetic force, we may suppose them to convey currents. May not these, to some extent at least, account for the diurnal variations of terrestrial magnetism? If this be the case we should have a ready explanation of the likeness observed by Mr. Baxendell between the wind curves and those of the declination.

I have hitherto alluded only to atmospheric currents, but there are also oceanic currents, and more especially there is the tidal wave, which occurs twice every lunar day. No doubt the influence of the tidal wave, as a moving conductor, must be very small: but may it not help to account for the lunar-diurnal variation, which is very small likewise?

But if there is an electric current of this kind in the ocean, it ought to be detected by the system of earth current wires which Mr. Airy has at Greenwich, inasmuch as the surface of the earth and the ocean are in electric communication with each other. Mr. Airy has, if I am not mistaken, detected indications of lunar-diurnal inequalities in the results of his observations. On the other hand, he has detected no current with a single daily period that would account for the diurnal variation—a result in accordance with these views, since the currents producing such would be in the upper regions of the atmosphere.

These views are given in order to invite criticism and

© 1870 Nature Publishing Group

comment; and they will have served their purpose if they direct attention to the part played in the phenomena of terrestrial magnetism by moving conductors. It will be noticed that they leave untouched the mysterious and important connection between sun spots and magnetic disturbances.

B. STEWART

P.S.—Since writing the above, Prof. Sir W. Thomson has informed me that Faraday tried to detect induction currents by tides in the Thames, but found no positive result. In an article in the *Philosophical Magazine*, Dec. 1851, Prof. Sir W. Thomson quotes this idea of Faraday, and makes a proposal to test it from tides in the Channel. He also discusses the part which may be played in the phenomena of terrestrial magnetism by moving conductors.

BRITISH RAINFALL

MR. G. J. SYMONS (62, Camden Square, N.W., December 22, 1869) sends us the following list of localities whence observations are "urgently required;" we think he will have many volunteers:—Cornwall: Falmouth, Jacobstow. Devon: Hatherleigh, Hartland, Exmoor. Dorset: Bere Regis. Oxford: Thame. Surrey: Redhill. Suffolk: Halesworth, Mildenhall. Lincoln: Kirton. Nottingham: Mansfield. Warwick: Stratford-upon-Avon. Shropshire: Bishop's Castle. Yorkshire: Milford Junction, Pateley Bridge, Kettlewell, Askrigg, Driffield, Bridlington, on the North York Moors. Lancashire: Broughton. Northumberland: Haltwhistle. Cumberland: Kirkoswald. Westmoreland: Ravenstonedale. Isle of Man: any part of the Island. Pembroke: Tenby, Fishguard. Cardigan: Aberaeron, Brecknock, Llanwrtyd. Radnor: Builth, Knighton. Montgomery: Montgomery, Llanfyllin. Merioneth: Barmouth, Harlech. Carnarvon: Pentrevoclas. Wigtown: Northern part of. Kirkcudbright: Western part of. Peebles: Peebles, Biggar. Ayr: Muirkirk. Argyle: Mull of Cantire, Ballimore, Glencoe, near Ben Cruachan. Perth: North-west part of. Forfar: Western part of. Inverness: along the Caledonian Canal, and in Lochaber. Aberdeen: North-west part of. Nairn: any part of. Banff: Southern part of. Ross: any place inland, or in Lewis or Harris. Sutherland: any place inland. Caithness: any place inland. Ireland: except from the vicinity of Belfast, Dublin, Londonderry, and Waterford, where there are many observers, returns are required from nearly all parts of the country.

THE LATE PROFESSOR MICHAEL SARS, OF CHRISTIANIA

THIS eminent zoologist died on the 22nd of October last; and his loss will be much felt by all naturalists who have benefited, as I have done, by his long, laborious, and conscientious investigation of the invertebrate fauna of the Norwegian seas.

He was born on the 30th of August, 1805, at Bergen, where his father was a shipowner. After finishing his academical studies at Christiania, and evincing at an early age his predilection for natural science, he entered into priest's orders, and in 1830 became pastor at Kinn, in the diocese of Bergen. Ten years afterwards he had charge of the parish of Manger in the same diocese. As both these parishes were on the sea-coast, Sars had constant opportunities of pursuing his zoological researches. In 1829 he published his first essay, entitled "Bidrag til Söedyrenes Natur-historie," and in 1846 the first part of his celebrated work "Fauna littoralis Norvegiæ." In 1854 he was appointed Professor Extraordinarius of Zoology at the University of Christiania, a position which he filled up to the time of his lamented death with great honour to his country, and to the satisfaction of the whole world of science. His celebrity as a zoologist, as well as a palæontologist, was fully recognised by all naturalists and geologists, and he was elected a member of several foreign scientific societies. Our own distinguished countryman, the late Edward Forbes, individually showed his appreciation of Sars's labours in eloquent pages (66 and 67) of his own posthumous work, "The Natural History of the European Seas," when he said, "More complete or more valuable zoological researches than those of Sars have rarely been contributed to the science of Natural History, and the success with which he has prosecuted investigations claiming not only a high systematic value, but also a deep physiological import, is a wonderful evidence of the abundance of intellectual resources which genius can develop, however secluded and wherever its lot be cast;" and he added that the name of this Norwegian priest, "who reaped reputation when seeking no more than knowledge familiar to every naturalist in Europe and America, in Asia, and at the Antipodes—for there are great naturalists settled far in the south, and many in the far east—is a sufficient proof that able work brings the rewards of applause and veneration, even when they be unasked for." By the observations of Sars on the development of the Medusæ he greatly advanced our knowledge of that remarkable physiological phenomenon known as the alternation of generations, which Chamisso had first indicated in the Salpæ. His last publication, "Mémoire pour servir à la connaissance des Crinoïdes vivants," caused especial interest, by showing that a race of animals, supposed to be extinct for a period so long as only to be measured by the duration of several past geological epochs, occurred in a living state in the abysses of the Norwegian seas. This discovery mainly induced the recent exploration of our own seas at great depths, which has produced such wonderful results; and the living Crinoid, or "stone-lily" (*Rhizocrinus Lofotensis*), has now been ascertained to inhabit many parts of the Atlantic from the Loffoden Isles to the Gulf of Mexico. The published works of Sars are seventy-four, and they are not less sound and valuable than numerous. One of his sons, Dr. George Ossian Sars, inherits the zoological inclinations and talent of the late Professor, and is second to none in the knowledge of the Sessile-eyed Crustacea.

It is exceedingly to be regretted that, in spite of the most rigid economy, the large family of Professor Sars is left in very impoverished circumstances, six of his children being wholly unprovided for. May I hope that naturalists and lovers of science will assist me in making a subscription for the temporary relief of this distressed family, and that they will by such tribute to his memory express their admiration of his career and services? I shall be very glad to receive any contributions.

J. GWYN JEFFREYS

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his Correspondents. No notice is taken of anonymous communications.*]

Cuckows' Eggs

I AM very grateful to Mr. Sterland for asking for further information "on some points of difficulty" in my recent paper on Cuckows' Eggs, because it shows me where I have failed in making myself plainly understood. In endeavouring to reply so far as lies in me to his questions, I will take them in order.

1. "Are they [Cuckows' Eggs] so variable as some assert?"

Mr. Sterland supports the doubt here indicated by the statement of "one of the most eminent and experienced of living oologists;" but who this oologist may be he leaves to be guessed, and I venture with all respect to remark, that quoting an anonymous authority in natural history is quoting no authority at all. I am therefore not willing to bring such experience as I myself have had into conflict with that of this eminent but nameless person. Still, as Mr. Sterland is not satisfied with the opinion on this

© 1870 Nature Publishing Group